Methomyl Executive Summary for Draft Biological Evaluation

This Biological Evaluation (BE) assesses potential risks that registered uses of methomyl (PC code 090301) may pose to an individual of a listed species or designated critical habitat. The federal action considered in this BE is the Registration Review for methomyl, which encompasses the review of all the registered uses, and the approved product labels for all pesticide products containing methomyl.

Listed species include those that are federally listed as endangered and threatened, as well as those that are proposed and candidates for listing and experimental populations. The methods employed in this BE follow the Revised Method for National Level Listed Species Biological Evaluations of Conventional Pesticides (referred to as the "Revised Method")[1]. The Revised Method incorporates comments from the public, US Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS) and US Department of Agriculture (USDA).

As described in the Revised Method, EPA's development of this BE includes two steps. The BE includes an evaluation of whether an individual of a listed species is reasonably expected to be exposed to a pesticide at a level that results in a discernible effect, and, if so, distinguishes effects that are likely to adversely affect an individual of a species from those that are not likely to adversely affect an individual. This process is also applied to the designated critical habitat of listed species (when available). In Step 1, for every listed species and designated critical habitat, EPA determines whether methomyl will have No Effect (NE) or May Affect (MA) (separate determinations made for each species and critical habitat). For those species and critical habitats with MA determinations, in Step 2, EPA will determine if methomyl is Not Likely to Adversely Affect (NLAA) or Likely to Adversely Affect (LAA) each individual species or critical habitat. Details on the method, models and tools used for making NE, NLAA and LAA determinations are provided in the Revised Method document.

1. General Information

Methomyl is an insecticide used on a wide variety of terrestrial food and feed crops, terrestrial non-food crops, greenhouse food/non-food, and non-agricultural indoor and outdoor sites. There are currently 3 active registrants of methomyl with 34 active product labels (16 Section 3s, 18 Special Local Needs), which include formulated products and technical grade methomyl (see **APPENDIX 1-1**). All of the formulated methomyl products, with the exception of the fly bait products, are Restricted Use Pesticides (RUPs) – meaning that they can only be applied by, or under the supervision of, a certified applicator. Methomyl can be applied in a liquid, granular (corn only), scatter bait, bait station, or as a brush-on paste. Aerial and ground application methods (including broadcast, soil incorporation, orchard airblast, and chemigation) are allowed. Registered labels for granular products require a 25-foot (ground) buffer zone adjacent to waterbodies (see **APPENDIX 1-2** for details).

Methomyl enters the environment via direct application to use sites. It may move off-site via spray drift and runoff. Studies indicate that the major route of methomyl transformation in the environment is aerobic and anaerobic biodegradation. There are data that indicate that abiotic hydrolysis under neutral and acidic conditions, photodegradation, and volatilization do not play a significant role in the degradation and dissipation processes. Based on methomyl's aerobic soil metabolism and aerobic and anaerobic aquatic metabolism data, methomyl is not considered persistent in the environment.

[1] Available at: https://www.epa.gov/endangered-species/revised-method-national-level-listed-species-biological-evaluations-conventional

Information on leaching and adsorption/desorption indicate that methomyl is considered mobile. Low octanol/water partition coefficient (log K_{ow} 0.12) suggests that the chemical will have a low tendency to accumulate in aquatic and terrestrial organisms. Methomyl has no degradates that are considered residues of toxicological concern (see **Chapter 3**).

Methomyl is an N-methylcarbamate insecticide. Carbamate insecticides act by inhibiting acetylcholinesterase, thereby reducing the degradation of the cholinergic neurotransmitter acetylcholine. As a result, intersynaptic concentrations of acetylcholine increase as the neurotransmitter accumulates leading to increased firing of the postsynaptic neurons which may lead to convulsions, paralysis, and death of an organism exposed to the chemical. Acetylcholinesterase inhibition is rapidly reversed in many taxa once exposure to an N-methylcarbamate insecticide has ended.

Methomyl is classified as highly toxic to birds and mammals on an acute exposure basis. Growth and reproductive endpoints were also affected in chronic studies at a variety of concentrations in birds and mammals, with mammals showing greater sensitivity than birds. Methomyl is highly toxic to beneficial insects and bees on an acute exposure basis, and it exhibits toxicity to adult bees on a chronic exposure basis. Methomyl is classified as very highly toxic to freshwater fish and moderately toxic to estuarine and marine fish on an acute exposure basis. Methomyl is characterized as very highly toxic to freshwater and estuarine and marine invertebrates on an acute exposure basis. There are reported ecological incidents involving methomyl use for aquatic animals, birds, mammals, terrestrial invertebrates, and terrestrial plants which are detailed in **Chapter 2**.

2. Exposure Methods

Exposure values are based primarily on fate and transport model results. Aquatic exposures (surface water and benthic sediment pore water) are quantitatively estimated for representative methomyl uses in specific geographic regions within generic habitats (referred to as bins) using the Pesticide Root Zone Model (PRZM5) and the Variable Volume Water Model (VVWM)[2] in the Pesticides in Water Calculator (PWC). Aquatic exposure results for the bin(s) most appropriate for the species and/or critical habitat being assessed are discussed in **Chapter 3**. Also discussed in **Chapter 3** are available water monitoring data for methomyl. For terrestrial exposures, existing models [*e.g.*, TerrPlant, AgDRIFT, AGDISP, earthworm fugacity model, Terrestrial Herpetofaunal Exposure Residue Program Simulation (T-HERPS), Terrestrial Residue Exposure model (T-REX) and portions of the Terrestrial Investigation Model (TIM)] were combined and modified into a single tool that is referred to as the MaGTool (**Chapter 4**).

[2] The exposure models can be found at: http://www.epa.gov/pesticides/science/models_pg.htm

Overlap Analyses

Step 1 of the BE involves an analysis of the potential overlap of the action area and individual species ranges and critical habitat. The action area was derived in ArcGIS 10.7 by combining the use data layers representative of methomyl uses and then buffering them out to the off-site transport distance estimated using the AgDRIFT model (**APPENDIX 1-6**). The overlaps of the action area and individual species ranges or critical habitats were calculated. For 216 species and 228 critical habitats with no overlap (*i.e.,* species found outside of the action area), NE determinations were made. This analysis used spatial data of species' ranges and habitats from FWS and NMFS. In the contiguous United States, agricultural use sites are represented using the US Department of Agriculture's (USDA) Crop Data Layer (CDL) (**APPENDIX 1-5**). Other data sources were used to represent agricultural areas in states and US territories outside of the contiguous United States, for which the CDL is not available. All species or critical habitats with some overlap of the action area and their range or designated critical habitat, or with some overlap on species that the listed species depends on (**Chapter 4**) were assessed in the MAGTool to make LAA/NLAA determinations.

3. Effects Determinations

The MAGTool estimates the number of individuals of a listed species that are potentially affected, incorporating the degree of overlap of a species range with potential use sites and associated usage data for a chemical (and associated off site transport areas) into the effects determinations. Using the toxicity endpoints for each taxa (**Chapter 2**), MAGTool utilizes probabilistic methods to assess how likely methomyl will adversely affect each species under the conditions of the model. Details on the individual effects determinations are found in **APPENDIX 4-1**. For each LAA determination, this assessment employed three categories (*i.e.,* strongest, moderate and weakest) to characterize the strength of the weight of evidence. To help determine the potential for risk, the MAGtool incorporates many of EPA's standard pesticide exposure models to estimate exposures to listed species and their prey, pollination, habitat, and dispersal (PPHD). If the model estimates are not considered representative of the exposure of the species (due to an inconsistency in the exposure model and assessed species' habitat), a qualitative analysis was conducted. In those cases, EPA made either a LAA or a NLAA determination based on a qualitative weight of evidence.

For 1745 listed species, and 776 designated critical habitats, an NE, NLAA or a LAA determination is made. For each species and designated critical habitat, the effects determination is based on the methodology detailed in **Chapter 1** and the Revised Method.[3] NE determinations were made for 216 listed species and 228 critical habitats. MA determinations were made for the 1529 species and 548 critical habitats. Specific species determinations are provided in **APPENDIX 4-1.** All species given a MA determination at Step 1 progressed to the Step 2 analysis where an NLAA or LAA determination is made. NLAA determinations were made for 415 species, and 213 species' critical habitats. LAA determinations were made for 1114 species and 335 critical habitats.

For approximately 62% of all species and 42% of critical habitats, an LAA determination was made. Of those LAA determinations, 29% were considered to have strongest evidence of LAA, 44% were considered to have moderate evidence of LAA, and 27% were considered to have weakest evidence of LAA. In considering prominent risk drivers, the pasture use data layer (which represents use on alfalfa for methomyl) was cited as the top use site associated with impacts to species or critical habitats with

[3] Available online at: https://www.epa.gov/endangered-species/revised-method-national-level-listed-species-biological-evaluations-conventional

LAA determinations. LAA determinations were made for species across all taxa. For certain species and critical habitats, there were uncertainties in the methomyl effects determinations based on the resolution of spatial data, resolution of usage data, and the threshold for assessing impacts on PPHD (detailed in **Chapter 4**). Tables 1 and 2 summarize the NE, NLAA and LAA determinations for species and critical habitats (respectively). **Tables 1** and **2** summarize the NE, NLAA and LAA determinations for species and critical habitats. **Table 3** summarizes the strength of evidence classifications for the LAA determinations.

TABLE 1. Summary of Species Effects Determinations for Methomyl (Counts by Taxon).

Taxon	Step 1 Effects Determinations		Step 2 Effects Determinations		Totals
	No Effect	May Affect	Not Likely to Adversely Affect	Likely to Adversely Affect	
Mammals	1	93	31	62	94
Birds	1	94	25	69	95
Amphibians	0	34	2	32	34
Reptiles	1	46	21	25	47
Fish	0	187	26	161	187
Plants	178	757	216	541	935
Aquatic Invertebrates	3	201	37	164	204
Terrestrial Invertebrates	32	117	57	60	149
Total	216	1529	415	1114	1745
Percent of total*	12%	85%	23%	62%	

* Represents % of all species on list including the 50 species for which effects determinations were not made (1795)

TABLE 2 Summary of Critical Habitat Effects Determinations for Methomyl (Counts by Taxon).

Taxon	Step 1 Effects Determinations		Step 2 Effects Determinations		Totals
	No Effect	May Affect	Not Likely to Adversely Affect	Likely to Adversely Affect	
Mammals	1	31	10	21	32
Birds	6	22	3	19	28
Amphibians	0	24	3	21	24
Reptiles	4	12	7	5	16
Fish	0	104	9	95	104
Plants	201	252	156	96	453
Aquatic Invertebrates	1	69	8	61	70
Terrestrial Invertebrates	15	34	17	17	49
Total	228	548	213	335	776
Percent of total*	29%	69%	27%	42%	

* Represents % of all species on list including the 16 critical habitats for which effects determinations were not made (792)

Table 3. Classification of LAA Determinations by Strength of Evidence.

Strength of LAA call	Species range	Critical Habitat

	Number	% of LAA determinations	Number	% of LAA determinations
Strongest evidence of LAA	325	29%	158	47%
Moderate evidence of LAA	496	45%	109	33%
Weakest evidence of LAA	293	26%	68	20%